Acta Zootaxonomica Sinica, 36 (4): 849 - 853 (Oct. 2011) ISSN 1000-0739
动物分类学报

NOTE ON THE GENUS *FUNICULUS* HEUDE (EUTHYNEURA, ENOIDEA), WITH DESCRIPTION OF A NEW SPECIES

WU Min, XU Qin
School of Life Science, Nanjing University, Nanjing 210093, *China*; *E-mail*: *minwu*1969@*yahoo.cn*

Abstract The genus *Funiculus* Heude, 1888, comprising *F. delavayanus*, *F. debilis*, *F. probates*, *F. asbestinus*, *F. coriaceus* and *F. laurentianus* before this work, was revised in brief. The 7th species *Funiculus songi* sp. nov. was described from Yunnan, based on the diagnostic shell shape and the apertural structure. Besides, this species gives the chance for learning the anatomy of the genus.

Key words Enoidea, *Funiculus*, new species, Yunnan.

1 Introduction

Funiculus Heude, 1888 (*Funiculus* Heude, 1888; 1890: 147) is a genus of Buliminuinae Schileyko, 1998 (= Buliminida L. Pfeiffer, 1879: 282), with the originally designed type species *Buliminus delavayanus* Heude, 1885. As a genus with a few species narrowly distributed in Dali and its neighboring region, the genus was defined as "shell subcylindrical, apex not acute, sinistral or dextral, with numerous whorls. Embryonic whorls smooth, polished. Postnuclear smooth. Aperture not armed, almost not oblique. Whorls 11 - 15, shell height 15 - 30 mm, shell diameter 3 - 6 mm". Till now there are six known species, namely *Funiculus coriaceus* Heude, 1890, *F. delavayanus* (Heude, 1885), *F. probatus* Heude, 1890, *F. asbestinus* Heude, 1890, *F. debilis* Heude, 1890, and *F. laurentianus* (Gredler, 1884). *Funiculus rudens* Heude, 1890 (Heude, 1890: 148, pl. 35, fig. 16.) is excluded as a synonym of *Pseudobuliminus doliolum* (Gredler) (Gredler, 1891, p. 77).

A new species, *Funiculus songi* sp. nov., is recently recognized from our terrestrial mollusc collected in Yunnan. Before the present work, the genus is known from N-Yunnan (Dali), SW-Sichuan, Chongqing and Hubei (Badong).

2 Material and Method

Living specimen was relaxed by being drowned in water, transferred to 70 % ethanol which was replaced with ethanol of the same concentration after about 72 hr. Measurements of shells were taken with 0.1 mm accuracy. Shells were measured with a calibrated digital vernier caliper. Whorl numbers were counted as described by Kerney and Cameron (1979) and taken with 1/8 (0.125) whorl accuracy. Directions used in descriptions: proximal = towards the genital atrium; distal = away from the genital atrium.

Abbreviations. At - atrium; AtR - atrial retractor muscle; A-1 - most proximal section of penial appendix; A-2 - penial appendix section between and thicker than A-1 and A-3, usually bulb-shaped; A-3 - section of the penial appendix connecting proximally A-2 and distally A-4; A-4 - thinnest part of the penial appendix between A-5 and A-3; A-5 - distal part of the penial appendix, more or less swollen; BC - bursa copulatrix; BCD - bursa copulatrix duct; D - diverticle of the bursa copulatrix duct; Ep - epiphallus; EpC - epiphallic caecum; ewh - embryonic whorl number; Fl - flagellum; fma - fully mature animal (s), i.e. shell (s) and soft parts; FO - free oviduct; h - height; P - penis; PR - retractor muscle of the penial branch; Va - vagina; VD - vas deferens; wh - whorl number (Wu and Gao, 2010).

3 Systematic Account

Euthyneura
Stylommatophora
Enoidea Woodward, 1903
Enidae Woodward, 1903
Pseudonapaeinae Schileyko, 1978

Funiculus Heude, 1888

Funiculus Heude, 1888; 1890: 147.
Type species: *Buliminus delavayanus* Heude, 1885.

Diagnosis. Shell subcylindrical or swollen near apex, sinistral or dextral, with 10.5 - 15.0 whorls. Embryonic whorls smooth, polished. Apex not acute. Postnuclear smooth. Aperture not armed, almost not oblique. Whorls 11 - 15, shell height 15 - 30 mm, shell diameter 3 - 6 mm.

Both epiphallic caecum and flagellum present. Penis innerly with two thick penial pilasters. Pilasters not forming V-shaped structure; without verge.

The project was supported by the National Natural Sciences Foundation of China (31071882) and the Science and Technology Ministry (2006FY120100).

Received 26 Apr. 2011, accepted 27 July 2011.

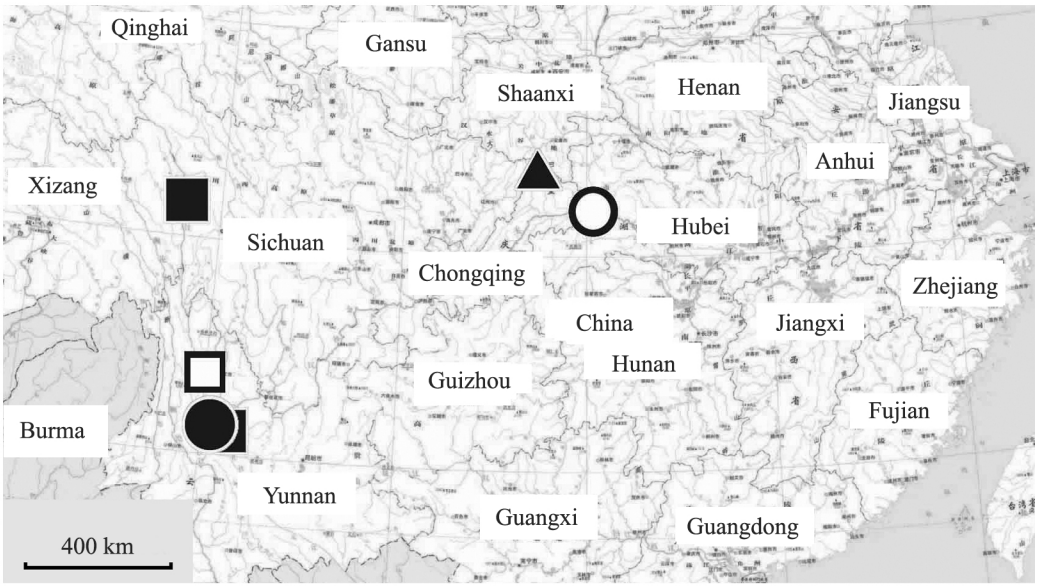

Fig. 1. Distribution map of the genus *Funiculus* Heude. ●*F. asbestinus* Heude, 1890; *F. debilis* Heude, 1890; *F. probatus* Heude, 1890. ■ *F. coriaceus* Heude, 1890. ▲ *F. delavayanus* (Heude, 1885). ○*F. laurentianus* (Gredler, 1884). □*F. songi* sp. nov.

Remarks. *Mirus meronianus* (Heude, 1890) was treated as the synonym of *Buliminus laurentianus* Gredler, 1884 (Gredler, 1891: 77). However, the latter species is more slender in building and with oblique columella, can be promptly distinguished from the former species, which is much conchologically close to *Mirus praelong* (Ancey, 1882).

Key to the species of *Funiculus*.

1. Shell dextral ····· 2
   Shell sinistral ····· 4
2. Shell with apex not acute ····· 5
   Shell with apex acute; columella vertical; outer edge of columellar lip oblique ····· 3
3. Shell height more than 25 mm ····· ***F. delavayanus***
   Shell height less than 25 mm ····· ***F. debilis***
4. Outer edge of columellar lip oblique; shell height more than 25 mm ····· ***F. probatus***
   Outer edge of columellar lip arched; shell height less than 25 mm ····· ***F. asbestinus***
5. Columella not oblique ····· 6
   Columella oblique; outer edge of columellar lip oblique ····· ***F. laurentianus***
6. Columella arched; outer edge of columellar lip arched ··· ***F. coriaceus***
   Columella straight; outer edge of columellar lip oblique ····· ***F. songi* sp. nov.**

***Funiculus songi* sp. nov.** (Figs 1 – 9)

Etymology. The new species is named in memory of Prof. SONG Da-Xiang, a well known zoologist, who passed away in 2008.

MHM04281, 1 fma with soft part. Yunnan, Lijiang, 5 July 2004, coll. SHI Kai.

Description. Shell with apex not acute; dextral; thin-shelled; semitranslucent; glossy; with most swollen part occurred at 4 whorls before penultimate whorl. With 12.3 whorls; 22.1 high; 5.1 in diam. maj. Height/diam. maj. ratio 3.9. Growthlines usually not very clear. Whorls flattened and not speckled. Embryonic shell polished; with 2.1 whorls. Postnuclear whorls smooth. Suture without narrow defined zone on beneath whorl. Last whorl straight in front; more or less straight at periphery; without smoothed spiral peripheral depression nor rugate part. Aperture sinuate; roundedly rhombic; slightly oblique; completely attached to body whorl; not armed; with angular tubercle; 5.3 high; 3.9 broad. Ratio of shell height to aperture height 4.21. Secondary aperture absent. Peristome sharp; expanded; reflexed with distinct cuff. Cuff made by the reflexed peristome curved backward. Parietal callus distinct. Columella vertical. Outer edge of columellar lip oblique axially. Umbilicus a narrow slit. Shell uniformly light horneous brown. Apical whorls normally colored.

Genitalia. Vas deferens long; evenly thick; entering epiphallus at some angle and with distinct demarcation with epiphallus. Epiphallus long; cylindrical and of uniform thickness; externally smooth; forming a few loops. Epiphallic caecum located in middle of epiphallus and apically blunt. Flagellum short; tubular; proximally normal and apically blunt. Penis thin-walled, clavate and distally enlarged, laterally entering epiphallus. Longitudinal pilasters two; not fused at epiphallic pore and not forming V-shaped structure. Penial process and verge absent. Penial appendix moderately long; branched off from penis at some distance from atrium; divided into sections (A-1 – A-5); with A-1 fused with A-2, and with distinct A-3, A-4 and A-5. A-1 moderately long and innerly with longitudinal pilasters. A-2 near A-3

Figs 2 – 6. *Funiculus songi* sp. nov., holotype. 2. Apertural view. 3. Abapertural view. 4. Lateral view. 5. Apertural view, in detail. 6. Abapertural view, in detail. Scale bar: 2 – 4 = 2 mm.

internally with a ring of papilla. A-3 opening into A-2 by needle-like long papilla. A-5 short and straight. State of penial retractor (uniramous or biramous) unknown. Penial branch attaching to medial penis. Muscular band connecting vagina and epiphallus absent. Atrium short and with strong atrial retractor. Free oviduct moderately long and longer than vagina. Vagina short; not swollen; straight; not lined with loose spongy tissue; unpigmented. Bursa copulatrix duct moderately long and proximally slightly twisted. Bursa copulatrix well defined and in normal size. Diverticle longer than reservoir; terminally seldom expanded. Bursa copulatrix and diverticle forked more distally from their base; distinguishable.

Distribution. Yunnan (only known from type locality).

Taxonomic remarks. The new species is quite distinguishable from the known species by most swollen part occurred at four equally expanded whorls before penultimate whorl (Figs 2 – 4), the well curved contour in left half (Figs 2 – 4), very sinuate aperture, broadly expanded columellar margin (Figs 5 – 6) and the conchological measurement. None of genitalian structure examined is novel in comparison to those of *Clausiliopsis* Möllendorff, 1901 (Wu and Wu, 2009), *Pupinidius* Möllendorff, 1901 (Wu and Zheng,

Figs 7 – 9. *Funiculus songi* sp. nov., holotype. 7. General view of genitalia. 8. Detailed penial appendage (A-5 and most A-4 lost here) and penis. 9. Inner view of penis, showing two thick pilasters. Scale bar = 1 mm.

2009), *Pupopsis* Gredler, 1898 (Wu and Gao, 2010), *Serina* Gredler, 1898 (Wu and Xu, in preparation) and other genera (Schileyko, 1998).

REFERENCES

Gredler, V. 1891. Kritische Fragmente. Ⅷ. *Chinesisches. Nachbl.*, 23: 75 – 82.

Heude, M. 1885. Notes sur les mollusques terrestres de la vallée du Fleuve Bleu. *Mémoires Concernant L'Histoire Naturelle de L'Empire Chinois*, 2: 89 – 132.

Heude, M. 1890. Notes sur les mollusques terrestres de la vallée du Fleuve Bleu. *Mémoires Concernant L'Histoire Naturelle de L'Empire Chinois*, 3: 133 – 178.

Kerney, M. P. and Cameron, R. A. D. 1979. A field guide to the land snails of Britain and North-West Europe. Collins, London. pp. 288, 24 pls.

Schileyko, A. A. 1998 Treatise on recent terrestrial pulmonate molluscs. Part 2. Gastrocoptidae, Hypselostomatidae, Vertiginidae, Truncatellinidae, Pachnodidae, Enidae, Sagdidae. *Ruthenica*, 2 (Suppl.): 129 – 261.

Wu, M and Gao, L 2010. A review of the genus *Pupopsis* Gredler, 1898 (Gastropoda: Stylommatophora: Enidae), with the descriptions of eight new species from China. *Zootaxa*, 2 725: 1 – 27.

Wu, M and Wu, Q 2009. A study of the type species of *Clausiliopsis* Möllendorff (Gastropoda, Stylomatophora: Enidae), with the description of a new species. *Journal of Conchology*, 40 (1): 91 – 98.

Wu, M and Zheng, W 2009. A review of Chinese *Pupinidius* Möellendorff (Gastropoda, Stylommatophora: Enidae), with the description of a new species. *Zootaxa*, 2 053: 1 – 31.

小索螺属（直神经亚纲，艾纳螺总科）一新种描述

吴　岷　徐　沁
南京大学生命科学学院　南京　210093，E-mail：minwu1969@yahoo.cn

摘　要　描述了栖息于云南丽江的艾纳螺科1新种宋氏小索螺 *Funiculus songi* sp. nov.。模式标本保存于南京大学。宋氏小索螺最膨大处出现在次体螺层以上4个螺层，一侧轮廓线弧形，壳口轴唇缘极扩展及测量特征等与小索螺属其它6个已知种（德氏小索螺 *F. delavayanus*、羸小索螺 *F. debilis*、优小索螺 *F. probatus*、左弓小索螺 *F. asbestinus*、皮小索螺 *F. coriaceus* 和劳氏小索螺 *F. laurentianus*）相区别。新种首次描述了小索螺属贝类的生殖系统构造。对小索螺属的鉴别特征进行了补充，并给出了该属的种检索表。

关键词　艾纳螺总科，小索螺属，新种，云南.
中图分类号　Q959.212

宋氏小索螺，新种 *Funiculus songi* sp. nov.（图1~9）

主要特征　贝壳最膨大处出现在次体螺层以上4个螺层，一侧轮廓线弧形，壳口轴唇缘极扩展。其测量特征为：螺层数12.3；壳高22.1；壳最大径5.1；胚螺层数2.1；壳口高5.3；壳口宽3.9。

正模 MHM04281，1成熟个体，具软体部分。云南丽江，2004-07-05，石凯采。

词源：为纪念动物学家宋大祥教授，新种种名以他的姓氏命名。

国家自然科学基金（31071882）和国家科技部科技基础性工作专项（2006FY120100）资助.